DOCUMENT RESUME

ED 317 584 TM 014 634

AUTHOR Reezigt, Gerry J.; Weide, Marga G.
TITLE The Effects of Group-Based Mastery Learning on Language and Arithmetic Achievement and Attitudes in Primary Education in the Netherlands.
PUB DATE Apr 90
NOTE 16p.; Paper presented at the Annual Meeting of the American Educational Research Association (Boston, MA, April 16-20, 1990).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; Achievement Gains; *Dutch; *Elementary School Students; Elementary Secondary Education; Foreign Countries; Grade 5; Grade 6; Grade 7; Grade 8; *Group Instruction; Instructional Effectiveness; Intermediate Grades; *Language Acquisition; *Mastery Learning; *Mathematics Achievement; Sex Differences; Student Attitudes; Teaching Methods
IDENTIFIERS *Adaptive Instructional Methods; Netherlands

ABSTRACT

As part of an educational reform in the Netherlands, teachers were required to implement models of adaptive instruction, including group-based mastery learning. It was expected that mastery learning would raise achievement and reduce differences in achievement among children of different social classes and between girls and boys. In 1987, students and teachers in grades 5 and 7 in 220 elementary schools participated in a study of the performance of the model. In 1988, the same students (who were then in grades 6 and 8) and their teachers participated. In all, about 10,000 children and 1,000 teachers were included in the study. All data were collected using questionnaires and Dutch standardized tests. Mastery learning was very popular for teaching mathematics, but the Dutch language was generally taught in a conventional way. In comparison with conventional instruction, few effects of mastery learning were found. Positive effects were found for language achievement in grade 5, and negative effects were found in the language achievement gain of grade 5 to 6. Differences in the achievement of children of different social classes and of boys and girls were not reduced by mastery learning. When the effects of other forms of adaptive learning (ability grouping and individualized instruction) were studied, mastery learning was the only form that did not lead to lower achievement scores than did class instruction. Possible explanations for the lack of success are reviewed. Eight tables present study data. (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

GERRY J. REEZIGT

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED317584

The effects of group-based mastery learning on language and arithmetic achievement and attitudes in primary education in The Netherlands

Gerry J. Reezigt

Marga G. Weide

Paper for the Annual Convention of the

American Educational Research Association

Boston, April 1990

RION, Institute for educational research
University of Groningen
P.O. Box 1286
9701 BG GRONINGEN
The Netherlands

TM 014 634

1. INTRODUCTION

In 1985 one of the major educational innovations since World War II in The Netherlands was completed: the integration of elementary school (age groups 4 to 6) and primary school (age groups 6 to 12) into one primary school for children in the age groups 4 to 12 (grades 1 to 8). The new primary school was supposed to guarantee a continuous development for all children. Two other important goals were reducing the achievement differences between children from different social classes, as well as reducing the achievement differences between boys and girls.

To reach the goals mentioned, a lot was expected from adaptive instruction. When instruction could be adapted to the needs of each individual child, all children would be able to develop themselves and their abilities in a continuous way and the differences between social classes and boys and girls could diminish.
In Dutch primary education, class instruction was the predominant way of teaching for a very long time. Children of the same age were grouped together in a class (the average class size being 25). Traditionally, all children were instructed in the same way, made the same exercises, went through the same curriculum in the same pace. No specific attention was paid to ability differences. As a result, the fast learners spent a lot of time waiting for the others to catch up, and the slow learners never got enough time to master all subjects and fell increasingly behind the other children.

To change this situation, teachers were stimulated to implement models of adaptive instruction. In The Netherlands, group-based mastery learning became by far the most popular model. The other models found in educational practice are within-class ability grouping and individualized instruction. It was expected that these models would have positive effects on pupil achievement and attitude and would reduce social class and sex-differences in achievement, because of the attention for individual needs.
In 1984 a research project started at RION, Institute for educational research of the University of Groningen, to investigate whether these high expectations were realistic.

2. EFFECTS OF GROUP-BASED MASTERY LEARNING

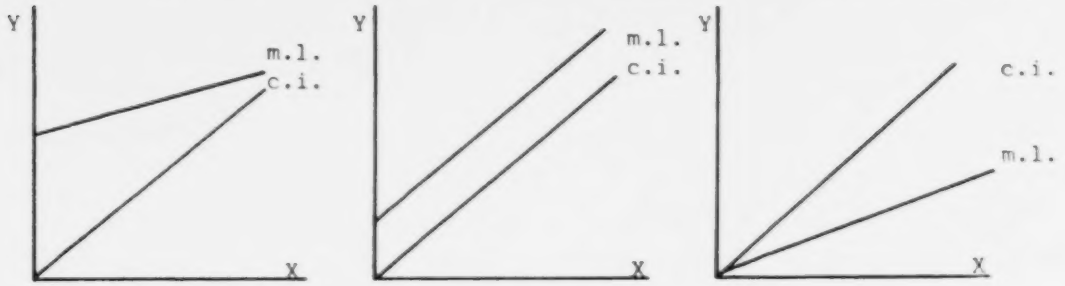
Group-based mastery learning was the subject of a lot of research studies in the past decades. Most research results are favourable: compared to class instruction, children almost always achieve better in the mastery learning condition. According to Bloom (1984a, 1984b), the achievement differences can amount to one standard deviation. Bloom also reports positive effects of mastery learning on pupil attitudes. Other positive results are reported by Burns (1979), Hyman & Cohen (1979) and Kulik & Kulik (1987).
Guskey & Pigott (1988) conclude in a recent meta-analysis of 46 studies that mastery learning nearly always leads to higher achievement than conventional class instruction, but that the effect

sizes in the various studies differ very much. Mastery learning seems to be most effective for primary school-pupils: effect sizes of .94 are found, while the effect sizes in secondary education and college are .48 and .41, respectively. Guskey and Pigott also found positive effects on student affect, although the effect sizes are generally smaller than the effect sizes for achievement.
The positive effects of mastery learning have been attacked by Arlin (1983, 1984a, 1984b) and Slavin (1987). According to Arlin, the effects are partly due to the greater time investment in the mastery learning condition: controlled for the extra time spent, the control students sometimes learn more effective than the mastery learning students.
Slavin (1987) concludes in his best-evidence synthesis on group-based mastery learning that most research shows considerable lacks: many studies are very short in duration, do not control for the unequal time investment in the mastery learning and control condition and use experimenter-made tests, instead of standardized measures (thereby putting the control group in a disadvantaged position). On the basis of studies that pass his criteria, he concludes that the effects of group-based mastery learning are closer to ¼ standard deviation on experimenter-made measures, and practically disappear on standardized measures.
There is hardly any Dutch empirical evidence on the effectiveness of mastery learning in primary education (in the Netherlands mastery learning is better documented in secondary and tertiary education). Results of a mastery learning approach in an educational priority program in primary education however are similar to the results reported by Slavin: the mastery learning students do show some progress on experimenter-made tests, but not on standardized measures (Slavenburg & Peters, 1989).

2.1. EVALUATION CRITERIA FOR THE EFFECTIVENESS OF MASTERY LEARNING

Very often the effects of mastery learning are reported in the form of mean scores for the experimental and control group. As Corno & Snow (1986) point out, comparing mean scores is just one single evaluation criterion and, in the case of mastery learning, not a very satisfying one. At least the standard deviations should be provided but in fact an Aptitude-Treatment-Interaction-approach is necessary (Corno & Snow, 1986; Stinard & Dolphin, 1981): what is beneficial for one child does not necessarily promote the same effects for another child.
In The Netherlands, it was expected that mastery learning would a. raise the achievement level of all children and b. reduce the differences in educational outcomes of children from different social classes on the one hand and boys and girls on the other hand.

Figure 1 hypothetical results of ATI-evaluations of mastery learning



X-axis: social class
Y-axis: achievement

m.l.: mastery learning
c.i.: class instruction

In figure 1A, this situation is reflected. In figure 1B, all children achieve better in the mastery learning condition but the differences between the social classes are unchanged. In figure 1C, these differences are reduced but now all children achieve at a lower level in the mastery learning condition. To find these patterns, looking at mean scores only is not enough: the possible interactions of mastery learning and student variables should also be the subject under study.

2.2. DIFFERENTIAL EFFECTS OF MASTERY LEARNING

When differential effects of mastery learning are reported, they almost always concern effects for children of different ability or intelligence levels.
There is some evidence that mastery learning is more beneficial for the slower learners. Kulik & Kulik (1987) for instance find effect sizes of 0.96 for the slower learners, and effect sizes of 0.43 for the faster learners.
Other studies reporting larger effects of mastery learning on the achievement of the slower students are those by Stinard & Dolphin (1981), Slavin & Karweit (1984), Fuchs, Fuchs & Tindal (1986) and Corno & Snow (1986). But these differential effects are not always found (Mevarech, 1985).
Some studies also indicate a reduction in achievement differences between students and a lower correlation between ability and achievement (Bloom, 1984a, 1984b; Kulik & Kulik, 1987), thereby supporting Bloom's 'vanishing point' thesis. Arlin however (1983, 1984a, 1984b), finds no signals of a growing together of the slower and faster learners: the differences stay roughly the same over a period of time. According to Arlin (1984b), mastery learning can have a Robin Hood - effect: learning time is taken from the academically rich and given to the academically poor; the faster learners can not proceed at their own pace and often holding them back is necessary. Slavin (1987) also points at this problem, but he concludes that although mastery learning may not be the ideal approach for the faster students, there is no evidence that they would achieve better in a conventional teaching situation. The problems in a mastery learning condition are also found in a conventional condition.

Social class differences and sex differences have not often been the subject of investigation. In the Netherlands, it was hoped that mastery learning would succeed in reducing social class and sex differences. Some studies find differential effects of mastery learning on children from different social classes. For instance, Mevarech (1986) finds effect sizes of 1.78 for lower class students in a mastery learning condition, in contrast to the smaller effect sizes for middle class (0.91) and higher class (0.66) students. Hyman & Cohen (1979) state mastery learning is especially beneficial for the achievement of lower class students, because it reduces the influence of the generally low teacher expectations for these children. That such a process may actually occur is shown by Guskey (1982).
Differential effects of mastery learning on boys and girls are not known until now.

2.3 RESEARCH QUESTIONS

The following research questions will be answered in this paper:

1. How many teachers in primary education in the Netherlands have implemented group-based mastery learning, and in what way?
2. What are the effects of group based mastery learning on language achievement, arithmetic achievement, and attitude toward language and arithmetic (compared to a)conventional class instruction and b) to ability grouping and individualized instruction)?
3. Are the effects of group-based mastery learning different for children with different intelligence levels, children from different social classes and boys and girls? More specifically: does group-based mastery learning lead to more educational equality between these groups of students?

3. METHOD

3.1. DATA COLLECTION

A survey study was undertaken in a random sample of 220 primary schools in the Netherlands (3% of the population). The study had a moderately longitudinal character: two cohorts of students were participating during two successive school years. In 1987 (two years after the formal integration of elementary and primary school) students and teachers of grades 5 and 7 participated; in 1988 the same students, now in grades 6 and 8, and their teachers participated. In total about 10.000 children and 1000 teachers cooperated.
All data were collected by means of questionnaires and well-known Dutch standardized tests, at the teacher level (model of instruction) as well as at the student level (intelligence, language and arithmetic achievement, attitude toward language and arithmetic).
Information on students' social class was given by the teacher, who rated occupational and educational level of both parents.

3.2. DATA ANALYSIS

As the data concern two levels of research (teacher and student),

multilevel procedures were applied, using the computer program VARCL for variance component analysis (Aitken & Longford, 1986; Longford, 1988).
The analyses were carried out separately for all dependent variables and for the different grades (5,6,7 and 8). Mastery learning (as well as ability grouping and individualized instruction) was contrasted with conventional class instruction.
The following procedure was used:

1. assessing the proportion of variance at teacher level (possibly to be explained by the teacher variable model of instruction) and at student level;
2. assessing whether the student variables intelligence, social class and sex have a significant effect on the dependent variable; if so, these variables were included as covariates in further analyses;
3. assessing the fixed or possibly also random significance of the covariates on the dependent variable (fixed: effects of a covariate go in the same direction in all schools; random: effects can vary from one school to another);
4. assessing the main effects on the dependent variable of model of instruction (mastery learning and both other models of adaptive instruction) controlled for fixed and random covariates;
5. assessing the interactions of model of instruction (mastery learning and both other models of adaptive instruction) and the random covariates; this part of the analysis was only performed when one or more covariates were also included as a random covariate.

3.3. SELECTION OF DATA FOR ANALYSIS

All teachers had to answer 6 questions on their daily practice concerning content covered and mastery of the curriculum at the end of the school year, adaptation to the entry level of students, way of assigning learning activities, way of progressing through the curriculum, way of dealing with pacing differences and way of instructing students.
On the basis of the answering pattern the model of instruction a teacher used was defined as mastery learning, conventional class instruction, ability grouping or individualized instruction.
Not all answering patterns could be clearly identified as one of these four models of instruction, however. About 25% of the teachers used elements of two models at the same time (without one of the models dominating the other), and about 15% used elements of more than two different models at the same time. These teachers were not included in the analyses. The same goes for about 12% of the teachers whose questionnaires were not complete: the VARCL-program is unable to deal with missing values.
The analyses refer to 502 teachers for language and 452 teachers for aritmethic.

4. RESULTS

4.1. GROUP-BASED MASTERY LEARNING IN THE NETHERLANDS

Mastery learning became a very popular way of teaching in the subject arithmetic. As for Dutch language, most teachers still teach in a conventional way (Table 1).

Table 1: Percentage of teachers using mastery learning and other models of instruction

	Language n=502	arithmetic n=452
- mastery learning	27%	48%
- class instruction	65	20
- ability grouping	3	14
- individualized instruction	5	18
	100%	100%

Teachers were identified as implementing mastery learning when they met at least 4 of the 6 following requirements:
- at the end of the school year, all students in the same school class have covered the same curricular content; faster students may have covered more;
- at the beginning of the school year, all students start at the same place in the curriculum;
- all students work through the same basic curriculum; apart from this, there are different activities for different groups of students;
- all students start to work through a learning unit at the same time and they also end at the same time; in the meantime, reteaching materials are available for the students who do not master the unit after initial instruction, while other students are provided with enrichment activities;
- pacing differences are dealt with by reteaching and enrichment activities;
- the initial instruction for each learning unit is class instruction; when necessary, the slower students get extra instruction afterwards.

The teachers also had to have adequate reteaching materials for the slower students at their disposal, preferably materials repeating the initial instruction in a different way or materials adapted to individual needs.

Essential elements of mastery learning are providing slower learners with enough time to master the subjects, regular diagnostic testing and feedback procedures, and availability of corrective reteaching materials (Guskey, 1987). Table 2 shows to what extent these elements are implemented, contrasted with conventional class instruction.

Table 2: Percentage of teachers implementing essential elements of mastery learning

	mastery learning		conventional class instruction	
	language n=136	arithmetic n=217	language n=326	arithmetic n=90
- extra time for slower students	74%	74%	62%	65%
- as much time as they need for slower students	9	16	4	9
- diagnostic testing at least once a month	58	61	43	44
- regular feedback after testing procedures	74	70	51	51
- reteaching materials repeating initial instruction in a different way	52	36	22	23
- reteaching materials adapted to needs of individual students	40	48	15	19

It is clear from table 2 that not all mastery learning teachers fully meet the requirements of mastery learning. Although nearly all teachers provide slower students with extra time when they do not master the subjects after initial instruction, they do not give them as much time as they actually need in most cases.
Although the majority of teachers take diagnostic tests at least once a month, about 25 percent fails to give regular feedback. Nearly all teachers have adequate reteaching materials at their disposal.
Compared to the teachers using conventional class instruction, it is clear the mastery learning teachers stand out in a positive way on all elements mentioned, most of all when the availability of adequate reteaching materials is concerned.

4.2. EFFECTS OF GROUP-BASED MASTERY LEARNING ON ACHIEVEMENT AND ATTITUDE

The proportions of variance at student and teacher level are different for language and arithmetic achievement, and also for attitude toward language and arithmetic (table 3).

Table 3: Proportions of variance at student and teacher level

	student level	teacher level
- language achievement	85%	15%
- arithmetic achievement	78	22
- attitude toward language	92	8
- attitude toward arithmetic	97	3

The proportion of variance at teacher level is the variance possibly explained by the teacher variable model of instruction. Table 3 shows this proportion is not very large for language and arithmetic achievement and even smaller for attitude toward language and arithmetic. This means teacher influence on achievement is larger than influence on attitude of students, but on all dependent variables it is rather small.

4.2.1. Effects on achievement

A substantial effect of mastery learning occurs when the same effects are found for language as well as for arithmetic achievement, and when the same effects are found in more than one grade.
The effects on achievement were investigated in different ways:

1. by checking whether mean scores in the mastery learning condition (controlled for significant covariates at student level) differ from mean scores in the conventional class situation;
2. by checking whether achievement gain in the mastery learning condition after one school year differs from achievement gain in the conventional class situation.

Table 4 shows mean scores for language achievement.

Table 4: Mean scores for language achievement (range 0-30)

	grade 5	grade 6	grade 7	grade 8
- mastery learning	21.3+	20.2	21.4	21.2
- class instruction	20.6	20.0	20.7	21.4
- ability grouping	19.5	16.9+	17.9*	19.5
- individualized instruction	19.0*	17.3*	19.6*	19.1*

+= deviance from class instruction significant at 10%-level
*= deviance from class instruction significant at 5%-level

Compared to class instruction, mastery learning leads to higher scores in grades 5, 6 and 7, but only in grade 5 the difference is statistically significant (at the 10%-level, VARCL-analyses, covariates intelligence, social class and sex). Ability grouping and individualized instruction show consistently lower scores in all grades.

Table 5 shows mean scores for arithmetic achievement.

Table 5: Mean scores for arithmetic achievement
(range: 0-20 grades, 5 6 and 7,
0-30 grade 8)

	grade 5	grade 6	grade 7	grade 8
- mastery learning	11.9	10.8	12.4	19.9
- class instruction	12.0	10.9	11.6	20.5
- ability grouping	10.3*	9.3*	10.3*	17.8*
- individualized instruction	12.1	9.9+	11.1	17.9*

+= deviance from class instruction significant at 10%-level
*= deviance from class instruction significant at 5%-level

Only in grade 7 the mastery learning students outperform the class instruction students, but the difference is not statistically significant. On the whole, the mastery learning scores do not differ from the class instruction scores. Ability grouping and individualized instruction again show lower scores in all grades (VARCL-analyses, covariates intelligence, social class and sex).

Converted to effect sizes (Burns, 1979), the average effect size for mastery learning compared to class instruction is .08 for language achievement and .02 for arithmetic achievement. The average effect sizes for ability grouping are -.31 for language achievement and -.31 for arithmetic achievement; the average effect sizes for individualized instruction are -.44 and -.21 for language and arithmetic achievement, respectively.

Table 6 shows the comparison of achievement gains in the various models of instruction. Achievement gain is defined as the achievement score in 1988, controlled for the achievement score in 1987 and for intelligence, social class and sex.
These analyses were only performed for those students who were taught two years in the same condition (language: 44% of all students, arithmetic: 35% of all students).

Table 6: Achievement gain deviance from class instruction

	language		arithmetic	
	grade 5/6	grade 7/8	grade 5/6	grade 7/8
- mastery learning	negative+	n.s.	n.s.	n.s.
- ability grouping	-	-	negative*	negative*
- individualized instruction	n.s.	negative*	negative+	negative+

+= deviance from class instruction significant at 10%-level
*= deviance from class instruction significant at 5%-level
n.s.= not significant

Mastery learning shows hardly any significant deviance from class instruction. Only in grade 5/6 students have lower language achievement gain scores in the mastery learning condition.
Again, the results for ability grouping and individualized instruction are fairly consequently negative (language achievement gain for ability grouping could not be analyzed because of too few students left).

On the whole, mastery learning leads to roughly the same achievement results as class instruction. The (incidental) significant differences are neither consequently found for both language and arithmetic, nor in all grades, and they are significant only at 10%-level. Opposed to mastery learning, ability grouping and individualized instruction consequently show significant negative deviances from class instruction.

The meaning of the effects should not be overestimated, however. The teacher variable model of instruction explains on the average only 14.3% of the variance at teacher level in language achievement, and 11.6% in arithmetic achievement.

4.2.2. Effects on student attitude

The mean attitude scores of students in the mastery learning condition do not differ significantly from the scores in the class instruction condition (table 7).

Table 7: Mean attitude scores for language and arithmetic (range 0-17)

	grade 5		grade 6		grade 7		grade 8	
	lang.	arith.	lang.	arith.	lang.	arith.	lang.	arith.
- mastery learning	10.9	13.0	11.6	12.2	10.8	11.9	11.5	12.2
- class instruction	11.1	12.8	11.9	12.5	11.0	12.1	11.4	12.3
- ability grouping	10.9	12.1	12.2	12.2	11.0	12.8+	10.8	12.5
- individualized instruction	11.4	13.2	10.8+	12.1	11.9	12.1	11.8	12.6

+= deviance from class instruction significant at 10%-level

Table 7 shows there are no consistent differences and certainly no significant differences in mean attitude scores between mastery learning and class instruction. Significant differences are once found for ability grouping and once for individualized instruction.
It is remarkable that these two models, whose effects on achievement were consequently negative, now show a somewhat opposite pattern: no negative effects are found, even some significant positive effects appear.

Converted to effect sizes, the average effect size for mastery learning, compared to class instruction, is -.04 for attitude towards language and -.02 for attitude towards arithmetic. The average effect sizes for ability grouping and individualized instruction are .01 (language) and -.02 (arithmetic), and .03 (language) and -.02 (arithmetic), respectively.

4.3. Differential effects of group-based mastery learning: intelligence, social class and sex

The correlations between intelligence and language achievement and between social class and language achievement are somewhat smaller in the mastery learning condition (.31 and .35) than in conventional class instruction (.34 and .39), and much smaller than in ability grouping (.50 and .46) and individualized instruction (.36 and .50). These results, showing a reduction in the language achievement differences due to intelligence and social class, are not found for arithmetic achievement, and disappear in the VARCL-analyses.

Interactions between mastery learning and the student variables intelligence, social class and sex were only specified in the analyses when one or more of these covariates could also be included as a random covariate.
As table 8 shows, this hardly ever occurred.

Table 8: Specification of fixed and random covariates in VARCL-analyses

dependent variable:	language achievement				arithmetic achievement				attitude toward language				attitude toward arithmetic			
grade:	5	6	7	8	5	6	7	8	5	6	7	8	5	6	7	8
covariate:																
- intelligence	F	F	F	F	F	F	F	R*	F	-	F	F	R*	F	F	F
- social class	R*	F	F	F	F	F	R	F	F	F	R	F	F	F	R	F
- sex	F	F	F	F	-	R	-	-	R	R	F	F	F	F	R	R

F= significant fixed covariate
R= significant random covariate
R*= significant interaction model of instruction - covariate at 5%-level.

Although intelligence, social class and sex nearly always have effects on the dependent variables, most of the time these effects go in the same direction in all schools (fixed effect). Only 11 times there are differences between schools in the relation of a covariate and a dependent variable (random effects). But only 3 of these 11 random effects have anything to do with the model of instruction a teacher uses, and they never refer to mastery learning.
The interactions with language achievement in grade 5 and arithmetic achievement in grade 8 both refer to ability grouping (larger differences between children than in the class instruction condition); the interaction with attitude toward arithmetic in grade 5 refers to individualized instruction (smaller differences between children than in the class instruction condition).

5. CONCLUSIONS AND DISCUSSION

Compared to conventional class instruction, hardly any effects of mastery learning are found. Positive effects are only found for language achievement in grade 5, negative effects are only found when the language achievement gain in grade 5/6 is concerned.
The same effects do not appear in grades 6, 7 and 8, nor in the subject arithmetic. No differential effects of mastery learning were found: differences in educational outcomes of children with different intelligence levels, children from different social classes and boys and girls are not reduced by mastery learning.
The main conclusion has to be that the effects of mastery learning are much the same as the effects of conventional class instruction.
However, compared to both other models of adaptive instruction mastery learning stands out as the only innovative way of teaching not leading to lower achievement scores than class instruction. Looking at the

research results from an innovators' point of view, mastery learning is by far the most successful innovation while ability grouping and individualized instruction cause rather undesirable achievement levels. The most likely explanation for this difference is the extent to which teachers have to change their usual way of teaching when they implement one of the models of adaptive instruction. Used to conventional class instruction as most teachers in the Netherlands are, mastery learning corresponds much more with this way of teaching than any of the other models.

Compared to many American studies, the effects of mastery learning in the Netherlands are somewhat disappointing. Referring to figure 1, the situation wished for is still far away. Some possible explanations are the following.

1. Teachers do not yet implement essential elements of mastery learning adequately; when they would test their students more often and provide slower students with more time to reach mastery, the results might be better.
2. Teachers may need more training in order to reach an adequate implementation of mastery learning; as it is now, teachers are not professionally supported when they leave conventional class instruction behind.
3. The curricular materials now used for mastery learning are possible inadequate. In the Netherlands, some curricula are designed (by commercial publishers) in accordance with mastery learning principles. Not all of these curricula however are systematically divided in hierarchical learning units, and not all of them provide the teachers with enough specific testing and corrective materials. This might well influence student results (Fuchs, Fuchs & Tindal, 1986).
4. Possibly the students in the mastery learning condition have reached more depth but less coverage of curricular content than students in the class instruction condition (Arlin, 1982).
   Because all students were only tested with general, standardized tests it could be that mastery learning students could not show off their greater depth.
5. The results may differ from the results of many American studies because of the time equality in the mastery learning and class instruction condition. In many experiments the mastery learning students spent more learning time than the control students. According to Slavin (1987), this is one of the major reasons of the effects of mastery learning in research studies.
6. The absence of any differential effect of mastery learning is surprising, as many American studies report differential effects for slower and faster learners.
   It may be that mastery learning does in fact reduce differences in cognitive entry behaviors, but not in general intelligence levels (Stinard & Dolphin, 1981). This study only looked at general intelligence levels, while other studies often use pretest scores as an indicator of ability.

The implementation of mastery learning may improve in the years to

come. When this actually occurs, further research may well find more positive effects.

SUMMARY

In the Netherlands, mastery learning is seen as an innovation to adapt education to the individual needs of children. Other innovative models of adaptive instruction are ability grouping and individualized instruction.
A survey study in a random sample of 220 primary schools was undertaken to assess the effects of these three models.
Compared to conventional class instruction, there are no substantial effects of mastery learning on language and arithmetic achievement nor on attitude toward language and arithmetic. Compared to ability grouping and individualized instruction, mastery learning stands out as the only innovational model that does not lead to lower achievement scores than class instruction.
No differential effects of mastery learning were found: mastery learning does not reduce differences in educational outcomes of children with different intelligence levels, of children from different social classes and of boys and girls.

REFERENCES

Aitkin, M., Longford, N.T. (1986). Statistical modelling issues in school effectiveness studies. *Journal of the royal statistical society, series* A, p. 1-43, part 1.

Arlin, M. (1982). Teacher responses to student time differences in mastery learning. *American Journal of Education*, vol. 90 nr. 4, p. 334-352.

Arlin, M. (1984). Time variability in mastery learning. *American educational research journal*, vol. 21 nr. 1, p. 103-120.

Arlin, M. (1984). Time, equality and mastery learning. *Review of Educational research*, vol. 54 nr. 1, p. 65-86.

Arlin, M. & Webster, J. (1983). Time costs of mastery learning. *Journal of educational psychology*, vol. 75 nr. 2, p. 187-195.

Bloom, B.S. (1984). The 2 sigma problem: the search for methods of group instruction as effective as one-to-one tutoring. *Educational Researcher*, p. 4-16.

Bloom, B.S. (1984). The search for methods of group instruction as effective as one-to-one tutoring. *Educational Leadership*, 42, p. 4-17.

Burns, R.B. (1979). Mastery learning: does it work? *Educational Leadership*, 37, p. 110-113.

Corno, L. & Snow, R.E. (1986). Adapting teaching to individual differences among learners. In M.C. Wittrock (ed.), *Handbook of research on teaching*.

Fuchs, L.S., Fuchs, D. & Tindal, G. (1986). Effects of mastery learning procedures on student achievement. *Journal of educational research*, vol. 79 nr. 5, p. 286-291.

Guskey, T.R. (1982). The effects of change in instructional effectiveness on the relationship of teacher expectations and student achievement. *Journal of educational research*, vol. 75 nr. 6, p. 345-349.

Guskey, T.R. (1987). The essential elements of mastery learning. *Journal of classroom interaction*, vol. 22 nr. 2, p. 19-22.

Guskey, T.R. & Pigott, T.J. (1988). Research on group-based mastery learning programs: a meta-analysis. *Journal of educational research*, vol. 81 nr. 4, p. 197-216.

Hyman, J.S. & Cohen, S.A. (1979). Learning for mastery: ten conclusions after 15 years and 3000 schools. *Educational Leadership*, 37, p. 104-109.

Kulik, C.L.C. & Kulik, J.A. (1987). Mastery testing and student learning: a meta-analysis. *Journal of Educational Technology systems*, vol. 15 nr. 3, p. 325-345.

Longford, N.T. (1988). *Variance component analysis: manual*. Princeton: Educational testing service.

Mevarech, Z.R. (1985). The effects of cooperative mastery learning strategies on mathematics achievement. *Journal of educational research*, vol. 78 nr. 6, p. 372-377.

Mevarech, Z.R. (1986). The role of a feedback-corrective procedure in developing mathematics achievement and self-concept in desegregated classrooms. *Studies in educational evaluation*, vol. 12, p. 197-203.

Slavenburg, J.H., Peters, T.A. (1989). *Het project Onderwijs en sociaal milieu: een eindbalans*. Rotterdam: SAD.

Slavin, R.E. (1987). Mastery learning reconsidered. *Review of educational research*, vol. 57 nr. 2, p. 175-213.

Slavin, R.E. & Karweit, N.L. (1984). Mastery learning and student teams: a factorial experiment in urban general mathematics classes. *American Educational Research Journal*, vol 21 nr. 4, p. 725-736.

Stinard, T.A. & Dolphin, W.D. (1981). Which students benefit from self-paced mastery learning and why. *Journal of educational psychology*, vol. 73 nr. 5, p. 754-763.